RESERVE COPY

PATENT SPECIFICATION

764,336

Inventor :—THOMAS BRUCE PHILIP.

Date of filing Complete Specification : Oct. 27, 1954.

Application Date : Nov. 17, 1953. No. 31793/53.

Complete Specification Published : Dec. 28, 1956.

Index at Acceptance :—**Class 83(4)**, T(2C : 6).

COMPLETE SPECIFICATION.

Improvements in or relating to the Joining of Metals by a Metallic Fusion Process.

We, THE DISTILLERS COMPANY LIMITED, a British Company, of 12 Torphichen Street, Edinburgh 3, Scotland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :

This invention relates to improvements in or relating to the joining of metals by a metallic fusion process, by which is meant throughout this Specification processes in which any metal is brought into the fused state during the process of effecting the join.

One of the difficulties in joining sheet metal by a metallic fusion process, particularly fusion welding by gas or electric arc, is the spread of heat from the weld through the materials being joined. This difficulty is particularly serious in the welding of a thin sheet to material of heavier section and in the welding together of two thin sheets. This spread of heat into the thin sheet causes a considerable warping and distortion adjacent to the weld. In the past attempts have been made to prevent this spread of heat by maintaining an area of the thin sheet, adjacent to the weld to be made, in contact with a large block of a metal which is a good conductor of heat, such as copper. This method of preventing the spread of heat from the weld is often awkward when the sheets to be joined are flat and is almost impossible when sheets having a curvature in more than one plane are to be joined. It is an object of the present invention to avoid or reduce these difficulties.

Accordingly there is provided a process for joining metals by a metallic fusion process characterised in that an area of metal adjacent to that being fused is cooled, at least in part, by solid carbon dioxide which is formed by directing upon the area to be cooled a jet from an orifice to which liquid carbon dioxide is supplied.

The stream of carbon dioxide can be delivered from one or more orifices, such as jets or capillary tubes, of internal diameter up to about 30 thousandths of an inch which may conveniently be carried on the welding appliance. Instead of plain jets or capillary tubes an orifice shaped like that of a fish tail gas burner can be used. The stream of carbon dioxide thus delivered forms a cooled barrier between the weld and the remainder of the material being welded. In the case where two thin sheets of material are being welded together streams of carbon dioxide may be delivered on either side of the weld. Furthermore the streams of carbon dioxide may impinge on the same side of the material being welded as the weld itself or on the opposite side. In certain cases it may be advantageous to apply carbon dioxide to both sides of the material. In hand welding the carbon dioxide orifice may either be attached to the welding appliance or may be handled independently, while in automatic welding the orifice is preferably attached to the welding appliance in those cases where the welding appliance itself moves while the material being welded remains stationary.

The carbon dioxide supplied to the orifice may be cooled isobarically during its passage from the supply reservoir to the delivery point whereby a greater proportion of the carbon dioxide emerging from the orifice is in the liquid and solid forms. Such cooling is particularly important in welding shops where the ambient temperature is high since carbon dioxide has a critical temperature of only 31° C. and cannot therefore exist in the liquid state in temperatures above this. Such isobaric cooling of the carbon dioxide is described in relation to the use of carbon

dioxide as a coolant in cutting operations, such as lathe turning, in co-pending Application Serial number 27485/53 (Serial No. 760,873).

The carbon dioxide may be supplied to the orifice from a bulk storage tank or from one or more portable cylinders. In the latter case the cylinders may conveniently be carried on a trolley incorporating an arrangement whereby empty cylinders may be exchanged for full ones without disturbing the continuity of supply. A method of changing cylinders without disturbing the continuity of supply is described in co-pending Application Serial Number 30569/53 (Serial No. 757,403).

In the drawings accompanying the Provisional Specification Figure 1 shows a welding torch (A) forming a weld (B) between a thin metallic sheet (C) and a bar (D). A capillary tube (E) delivering the stream of carbon dioxide cools the sheet (C) alongside the weld, thereby reducing the spread of heat into the sheet.

Figure 2 shows a welding torch (F) forming a weld (G) between two thin sheets of metal (H, J). Capillary tubes K_1 and K_2 eject streams of carbon dioxide on either side of the weld, thereby reducing the spread of heat.

What we claim is :—

1. A process for joining metals by a metallic fusion process characterised in that an area of metal adjacent to that being fused is cooled, at least in part, by solid carbon dioxide which is formed by directing upon the area to be cooled a jet from an orifice to which liquid carbon dioxide is supplied.
2. A process according to Claim 1 wherein the carbon dioxide is delivered from one or more capillary tubes.
3. A process according to Claim 1 or 2 wherein the carbon dioxide is cooled isobarically during its passage from the supply reservoir to the delivery point.
4. A process for joining metals by a metallic fusion process substantially as described with reference to the accompanying drawings.

N. F. BAKER,
Agent for the Applicants.

PROVISIONAL SPECIFICATION.

Improvements in or relating to the Joining of Metals by a Metallic Fusion Process.

We, THE DISTILLERS COMPANY LIMITED, a British Company, of 12 Torphichen Street, Edinburgh 3, Scotland, do hereby declare this invention to be described in the following statement :—

This invention relates to improvements in or relating to the joining of metals by a metallic fusion process by which is meant throughout this Specification processes in which any metal is brought into the fused state during the process of effecting the join.

One of the difficulties in joining sheet metal by a metallic fusion process, particularly fusion welding by gas or electric arc, is the spread of heat from the weld through the materials being joined. This difficulty is particularly serious in the welding of a thin sheet to material of heavier section and in the welding together of two thin sheets. This spread of heat into the thin sheet causes a considerable warping and distortion adjacent to the weld. In the past attempts have been made to prevent this spread of heat by maintaining the area of the thin sheet adjacent to the weld to be made in contact with a large block of a metal which is a good conductor of heat, such as copper. This method of preventing the spread of heat from the weld is often awkward when the sheets to be joined are flat and is well nigh impossible when sheets having a curvature in more than one plane are to be joined. It is an object of the present invention to avoid or reduce these difficulties.

Accordingly there is provided a process for joining metals by a metallic fusion process wherein an area adjacent to the metal being fused is cooled by a stream of carbon dioxide in the form of gas, liquid or snow, or any combination of these states, thereby reducing the spread of heat from the fused area into the surrounding metal.

The stream of carbon dioxide can be delivered from one or more jets or capillary tubes which may conveniently be carried on the welding appliance. Instead of plain jets or capillary tubes an orifice shaped like that of a fish tail gas burner can be used. The stream of carbon dioxide thus delivered forms a cooled barrier between the weld and the remainder of the material being welded. In the case where two thin sheets of material are being welded together streams of carbon dioxide may be delivered on either side of the weld. Furthermore the streams of carbon dioxide may impinge on the same side of the material being welded as the weld itself or on the opposite side. In certain cases it may be advantageous to apply carbon dioxide to both sides of the material. In hand welding the carbon dioxide orifice may either be attached to the welding appliance or may be welded independently, while in automatic welding the orifice

is preferably attached to the welding appliance in those cases where the welding appliance itself moves while the material being welded remains stationary.

The carbon dioxide supplied to the orifice may be cooled isobarically during its passage from the supply reservoir to the orifice whereby a greater proportion of the carbon dioxide emerging from the orifice is in the liquid and solid forms. Such cooling is particularly important in welding shops where the ambient temperature is high since carbon dioxide has a critical temperature of only 31° C. and cannot therefore exist in the liquid state in temperatures above this. Such isobaric cooling of the carbon dioxide is described in relation to the use of carbon dioxide as a coolant in cutting operations, such as lathe turning, in Application number 27485/53 (Serial No. 760,813).

The carbon dioxide may be supplied to the orifice from a bulk storage tank or from one or more portable cylinders. In the latter case the cylinders may conveniently be carried on a trolley incorporating an arrangement whereby empty cylinders may be exchanged for full ones without disturbing the continuity of supply. A method of changing cylinders without disturbing the continuity of supply is described in co-pending Application 30569/53. The trolley may also conveniently carry a refrigerator for cooling the carbon dioxide as described above.

In the accompanying drawings Figure 1 shows a welding torch (A) forming a weld (B) between a thin metallic sheet (C) and a bar (D). A capillary tube (E) delivering the stream of carbon dioxide cools the sheet (C) alongside the weld, thereby reducing the spread of heat into the sheet.

Figure 2 shows a welding torch (F) forming a weld (G) between two thin sheets of metal (H, J). Capillary tubes K_1 and K_2 eject streams of carbon dioxide on either side of the weld, thereby reducing the spread of heat.

N. F. BAKER,
Agent for the Applicants.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1956.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.

PROVISIONAL SPECIFICATION
This drawing is a reproduction of the Original on a reduced scale

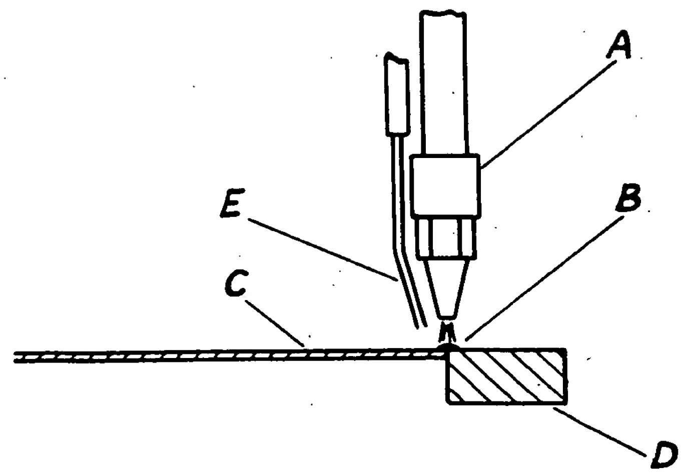

FIG. 1

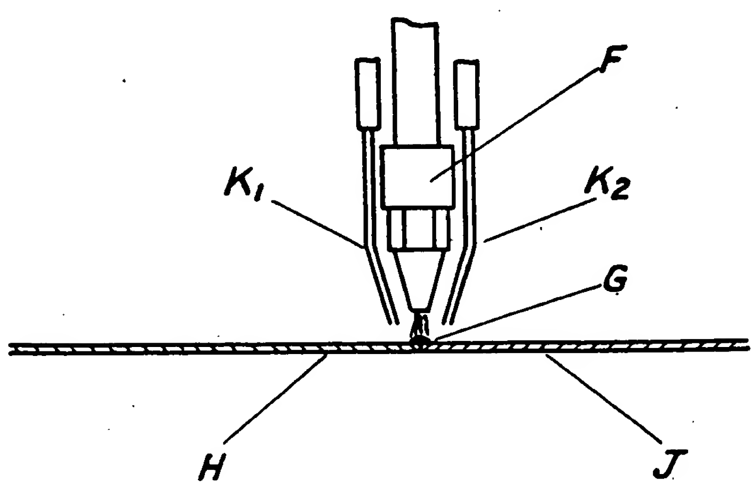

FIG. 2